

Claims

- [c1] 1. A data cartridge library comprising:
- a frame;
 - a shelf system, operatively attached to said frame, for supporting at least two cartridge magazines and comprising at least one shelf;
 - a drive that is operatively attached to said frame;
 - a magazine transport device, operatively attached to said frame, for moving a magazine comprised of a frame structure that defines a space for accommodating a plurality of data cartridges and an opening through which a data cartridge can be inserted/removed into/from the space, and a partitioning structure that divides the space into a plurality of substantially parallel slots with each slot capable of accommodating a data cartridge, and when such a magazine is associated with the library, the magazine is oriented such that a data cartridge held within one of said plurality of slots is oriented such that the face of the data cartridge with the greatest surface area lies in a substantially vertical plane; and
 - a cartridge transport device, operatively attached to said frame, for moving a data cartridge between a data cartridge magazine and said drive;
- wherein said magazine transport device is capable of moving a magazine to a site at which at least two of the plurality of

substantially parallel slots of the magazine are exposed to said cartridge transport;

wherein said cartridge transport comprises:

a grasper for grasping a data cartridge and releasing a previously grasped data cartridge; and

a grasper transport, located adjacent to said site, for horizontally displacing said grasper so that said grasper is able to insert/remove a data cartridge into/from each of the at least two of the plurality of substantially parallel slots of a magazine positioned at said site.

[c2] 2. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport comprises a lead screw.

[c3] 3. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport comprises a rack and pinion.

[c4] 4. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport comprises a pulley.

[c5] 5. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport comprises a rotary actuator.

[c6] 6. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport comprises a linear actuator.

[c7] 7. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport moves at least a portion of said grasper

along a substantially horizontal and straight line; and
said cartridge transport comprises means for rotating said
grasper about a substantially horizontal axis that is
substantially perpendicular to said straight line.

[c8] 8. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport moves at least a portion of said grasper
along a substantially horizontal and straight line; and
said cartridge transport comprises means for rotating said
grasper about a substantially horizontal axis that is
substantially parallel to said straight line.

[c9] 9. A data cartridge library, as claimed in claim 1, wherein:
said grasper transport moves at least a portion of said grasper
along a substantially horizontal and straight line; and
said cartridge transport comprises means for rotating said
grasper about a substantially vertical axis.

[c10] 10. A data cartridge library, as claimed in claim 1, wherein:
said cartridge transport comprises:
means for vertically moving at least a portion of said grasper
towards and away from said site so that said grasper is
capable of displacing a data cartridge within a substantially
vertical plane.

[c11] 11. A data cartridge library, as claimed in claim 10, wherein:
said cartridge transport comprises:

means for horizontally moving said grasper towards and away from said site so that said grasper is capable of displacing a data cartridge within a substantially vertical plane.

[c12] 12. A data cartridge library, as claimed in claim 1, wherein:
said grasper comprises:
a housing capable of accommodating a first data cartridge with a first height or a second data cartridge with a second height that is greater than the first height, with the height of a data cartridge being the distance between the two substantially parallel faces of the data cartridge that have the greatest surface area.

[c13] 13. A data cartridge library, as claimed in claim 1, wherein:
said magazine transport device and said cartridge transport comprise an elevator.

[c14] 14. A data cartridge library, as claimed in claim 1, further comprising:
means for reading a first label and a second label that are each potentially associated with a magazine when the magazine is associated with the library and that are each differently oriented to the other;
wherein the first label is associated with a magazine and is located in a first plane;
wherein the second label is associated with a data cartridge and located in a second plane that is different than said first

plane.

- [c15] 15. A data cartridge library comprising:
- a frame;
 - a shelf system, operatively attached to said frame, for supporting at least two cartridge magazines and comprising at least one shelf;
 - a drive that is operatively attached to said frame;
 - a magazine transport device, operatively attached to said frame, for moving a magazine comprised of a frame structure that defines a space for accommodating a plurality of data cartridges and an opening through which a data cartridge can be inserted/removed into/from the space, and a partitioning structure that divides the space into a plurality of substantially parallel slots with each slot capable of accommodating a data cartridge, and when such a magazine is associated with the library, the magazine is oriented such that a data cartridge held within one of said plurality of slots is oriented such that the face of the data cartridge with the greatest surface area lies in a substantially vertical plane; and
 - a cartridge transport device, operatively attached to said frame, for moving a data cartridge between a data cartridge magazine and said drive;
- wherein said magazine transport device is capable of moving a magazine to a site at which at least one of the plurality of

substantially parallel slots of the magazine are exposed to said cartridge transport;

wherein said cartridge transport comprises:

a grasper for grasping a data cartridge and releasing a previously grasped data cartridge; and

means for linearly moving at least a portion of said grasper relative to said site so that said grasper is capable of displacing a data cartridge within a substantially vertical plane.

[c16] 16. A data cartridge library, as claimed in claim 15, wherein: said means for linearly moving comprises means for vertically moving said grasper.

[c17] 17. A data cartridge library, as claimed in claim 15, wherein: said means for linearly moving comprises means for horizontally moving said grasper.

[c18] 18. A data cartridge library, as claimed in claim 15, wherein: said means for linearly moving comprises a lead screw.

[c19] 19. A data cartridge library, as claimed in claim 15, wherein: said means for linearly moving comprises a rack and pinion.

[c20] 20. A data cartridge library, as claimed in claim 15, wherein: said means for linearly moving comprises a pulley.

[c21] 21. A data cartridge library, as claimed in claim 15, wherein: said means for linearly moving comprises a rotary actuator.

- [c22] 22. A data cartridge library, as claimed in claim 15, wherein:
said means for linearly moving comprises a linear actuator.
- [c23] 23. A data cartridge library, as claimed in claim 15, wherein:
said cartridge transport comprises:
a grasper transport, located adjacent to said site, for
horizontally displacing said grasper so that said grasper is
able to insert/remove a data cartridge into/from each of the at
least two of the plurality of substantially parallel slot of a
magazine positioned at said site.
- [c24] 24. A data cartridge library, as claimed in claim 15, wherein:
said cartridge transport comprises:
means for rotating said grasper about a horizontal axis.
- [c25] 25. A data cartridge library, as claimed in claim 15, wherein:
said cartridge transport comprises:
means for rotating said grasper about a vertical axis.
- [c26] 26. A data cartridge library, as claimed in claim 15, wherein:
said grasper comprises:
a housing capable of accommodating a first data cartridge with
a first height and a second data cartridge with a second height
that is greater than the first height, with the height of a data
cartridge being the distance between the two substantially
parallel faces of the data cartridge that have the greatest
surface area.

[c27] 27. A data cartridge library, as claimed in claim 15, wherein:
said magazine transport device comprises:
a magazine picker for moving a magazine to and from said
shelf; and
an elevator;
said cartridge transport comprises said elevator.

[c28] 28. A data cartridge library, as claimed in claim 15, further
comprising:
means for reading a first label and a second that are each
potentially associated with a magazine when the magazine is
associated with the library and that are each differently
oriented to the other;
wherein the first label is associated with a magazine and is
located in a first plane;
wherein the second label is associated with a data cartridge
and located in a second plane that is different than said first
plane.

[c29] 29. A data cartridge library comprising:
a frame;
a shelf system, operatively attached to said frame, for
supporting at least two cartridge magazines and comprising at
least one shelf;
a drive that is operatively attached to said frame;
a magazine picker, operatively attached to said frame, for

moving a magazine to and from said shelf; and
a cartridge transport, operatively attached to said frame, for
moving a data cartridge between a data cartridge magazine
and said drive;
wherein said cartridge transport comprises an elevator;
wherein said elevator supports said magazine picker.

[c30] 30. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises a carriage;
wherein said magazine picker is operatively attached to said
carriage.

[c31] 31. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises:
means for moving said magazine picker in one rectilinear
dimension.

[c32] 32. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises:
means for moving said magazine picker in two rectilinear
dimensions.

[c33] 33. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises:
means for moving said magazine picker along an arc with a
fixed radius.

[c34] 34. A data cartridge library, as claimed in claim 29, wherein:

said elevator comprises:
means for moving said magazine picker in a cylindrical space.

[c35] 35. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises:
an electrical motor.

[c36] 36. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises:
a first electrical motor; and
a second electrical motor.

[c37] 37. A data cartridge library, as claimed in claim 29, wherein:
said elevator comprises:
a counterweight.

[c38] 38. A data cartridge library, as claimed in claim 29, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a
previously grasped data cartridge; and
a grasper transport, located adjacent to said site, for
horizontally displacing said grasper.

[c39] 39. A data cartridge library, as claimed in claim 29, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a
previously grasped data cartridge; and
means for rotating said grasper about an axis.

[c40] 40. A data cartridge library, as claimed in claim 29, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a
previously grasped data cartridge; and
means for linearly moving at least a portion of said grasper
towards and away from a magazine so that said grasper is
capable of displacing a data cartridge within a substantially
vertical plane.

[c41] 41. A data cartridge library, as claimed in claim 29, wherein:
said cartridge transport comprises:
a housing capable of accommodating a first data cartridge with
a first height and a second data cartridge with a second height
that is greater than the first height, with the height of a data
cartridge being the distance between the two substantially
parallel faces of the data cartridge that have the greatest
surface area.

[c42] 42. A data cartridge library, as claimed in claim 29, further
comprising:
means for reading a first label and a second label that are
each potentially associated with a magazine when the
magazine is associated with the library and that are each
differently oriented to the other;
wherein the first label is associated with a magazine and is
located in a first plane;

wherein the second label is associated with a data cartridge and located in a second plane that is different than said first plane.

[c43] 43. A data cartridge library comprising:
a frame;
a shelf system, operatively attached to said frame, for supporting at least two cartridge magazines and comprising at least one shelf;
a drive that is operatively attached to said frame;
a magazine transport device, operatively attached to said frame, for moving a magazine;
a cartridge transport, operatively attached to said frame, for moving a data cartridge between a data cartridge magazine and said drive; and
means for reading a first label and a second label that are each potentially associated with a magazine when the magazine is associated with the library and that are each differently oriented to the other;
wherein the first label is associated with a magazine and is located in a first plane;
wherein the second label is associated with a data cartridge and located in a second plane that is different than said first plane.

[c44] 44. A data cartridge library, as claimed in claim 43, wherein:

said means for reading comprises:
a label reader; and
means for moving said label reader between a first orientation for reading a first label and a second orientation for reading a second label.

[c45] 45. A data cartridge library, as claimed in claim 44, wherein:
said means for moving comprises:
means for rotating said label reader.

[c46] 46. A data cartridge library, as claimed in claim 44, wherein:
said means for moving comprises:
means for rotating said label reader about a substantially horizontal axis.

[c47] 47. A data cartridge library, as claimed in claim 46, wherein:
said means for moving comprises:
means for rotating said label reader about a substantially horizontal axis and through an angular range that extends across a vertical plane that includes said substantially horizontal axis so that said label reader is capable of reading first labels associated with magazines located on both sides of said vertical plane.

[c48] 48. A data cartridge library, as claimed in claim 44, wherein:
said label reader is operatively attached to said cartridge transport.

- [c49] 49. A data cartridge library, as claimed in claim 44, wherein:
said means for moving comprises:
means for linearly translating said label reader.
- [c50] 50. A data cartridge library, as claimed in claim 43, wherein:
said means for reading comprises:
a first label reader for reading a first label; and
a second label reader for reading a second label.
- [c51] 51. A data cartridge library, as claimed in claim 50, wherein:
said first label reader is associated with said magazine
transport device.
- [c52] 52. A data cartridge library, as claimed in claim 51, wherein:
said magazine transport device comprises:
a magazine picker for moving a magazine in a direction to
associate a magazine with said shelf;
wherein said first label reader is associated with said
magazine picker and aligned in said direction.
- [c53] 53. A data cartridge library, as claimed in claim 50, wherein:
said second label reader is operatively attached to said
cartridge transport.
- [c54] 54. A data cartridge library, as claimed in claim 53, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a
previously grasped data cartridge; and

means for linearly moving at least a portion of said grasper in a direction towards a magazine;
wherein said second label reader is operatively attached to said cartridge transport and aligned in said direction.

[c55] 55. A data cartridge library, as claimed in claim 43, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a previously grasped data cartridge; and
a grasper transport for horizontally displacing said grasper.

[c56] 56. A data cartridge library, as claimed in claim 43, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a previously grasped data cartridge; and
means for rotating said grasper about an axis.

[c57] 57. A data cartridge library, as claimed in claim 43, wherein:
said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a previously grasped data cartridge; and
means for linearly moving at least a portion of said grasper towards and away from a magazine so that said grasper is capable of displacing a data cartridge within a substantially vertical plane.

[c58] 58. A data cartridge library, as claimed in claim 43, wherein:

said cartridge transport comprises:

a housing capable of accommodating a first data cartridge with a first height and a second data cartridge with a second height that is greater than the first height, with the height of a data cartridge being the distance between the two substantially parallel faces of the data cartridge that have the greatest surface area.

[c59] 59. A data cartridge library, as claimed in claim 43, wherein:
said magazine transport device comprises:
a magazine picker; and
an elevator;
wherein said cartridge transport comprises said elevator.

[c60] 60. A data cartridge library comprising:
a frame;
a shelf system, operatively attached to said frame, for supporting at least two cartridge magazines and comprising at least one shelf;
a drive that is operatively attached to said frame;
a magazine transport device, operatively attached to said frame, for moving a magazine; and
a cartridge transport, operatively attached to said frame, for moving a data cartridge between a data cartridge magazine and said drive;
wherein said cartridge transport comprises:

a grasper for grasping a data cartridge and releasing a previously grasped data cartridge; and
means for rotating said grasper about an axis.

- [c61] 61. A data cartridge library, as claimed in claim 60, wherein:
said means for rotating comprises means for rotating said grasper about a horizontal axis.
- [c62] 62. A data cartridge library, as claimed in claim 60, wherein:
said means for rotating comprises means for rotating said grasper about a vertical axis.
- [c63] 63. A data cartridge library, as claimed in claim 60, wherein:
said means for rotating comprises means for rotating a data cartridge about an axis that is parallel to the face of the data cartridge with the greatest area.
- [c64] 64. A data cartridge library, as claimed in claim 60, wherein:
said means for rotating comprises an electrical motor.
- [c65] 65. A data cartridge library, as claimed in claim 60, wherein:
said cartridge transport comprises:
a grasper transport for horizontally displacing said grasper so that said grasper is able to insert/remove a data cartridge into/from magazine.
- [c66] 66. A data cartridge library, as claimed in claim 60, wherein:
said cartridge transport comprises:

means for vertically moving said grasper so that said grasper is capable of displacing a data cartridge within a substantially vertical plane.

[c67] 67. A data cartridge library, as claimed in claim 60, wherein:
said cartridge transport comprises:

means for horizontally moving said grasper so that said grasper is capable of displacing a data cartridge within a substantially vertical plane.

[c68] 68. A data cartridge library, as claimed in claim 60, wherein:
said grasper comprises:

a housing capable of accommodating a first data cartridge with a first height and a second data cartridge with a second height that is greater than the first height, with the height of a data cartridge being the distance between the two substantially parallel faces of the data cartridge that have the greatest surface area.

[c69] 69. A data cartridge library, as claimed in claim 60, wherein:
said magazine transport device comprises:

a cartridge magazine picker; and
an elevator;

wherein said cartridge transport comprises said elevator.

[c70] 70. A data cartridge library, as claimed in claim 60, further comprising:

means for reading a first label and a second that are each potentially associated with a magazine when the magazine is associated with the library and that are each differently oriented to the other;
wherein the first label is associated with a magazine and is located in a first plane;
wherein the second label is associated with a data cartridge and located in a second plane that is different than said first plane.

[c71] 71. A data cartridge library comprising:
a frame;
a shelf system, operatively attached to said frame, for supporting at least two cartridge magazines and comprising at least one shelf;
a drive that is operatively attached to said frame;
a magazine transport device, operatively attached to said frame, for moving a magazine; and
a cartridge transport, operatively attached to said frame, for moving a data cartridge between a data cartridge magazine and said drive;
wherein said cartridge transport comprises:
a grasper for grasping a data cartridge and releasing a previously grasped data cartridge, said grasper comprising a housing capable of accommodating a first data cartridge with a

first height or a second data cartridge with a second height that is greater than the first height, with the height of a data cartridge being the distance between the two substantially parallel faces of the data cartridge that have the greatest surface area.

[c72] 72. A data cartridge library, as claimed in claim 71, wherein: said housing comprises:
a first member comprising a first planar surface;
a second member comprising a second planar surface that is separated from said first member by a distance that is greater than said first depth and less than said second depth; and
means, operatively connected to said first member, for allowing said first member to move relative to said second member so that said second member is separated from said first member by a distance that is greater than said second depth.

[c73] 73. A data cartridge library, as claimed in claim 72, wherein: said means comprises a spring.

[c74] 74. A data cartridge library, as claimed in claim 71, wherein: said cartridge transport comprises:
a grasper transport for horizontally displacing said grasper so that said grasper is able to insert/remove a data cartridge into/from a magazine.

- [c75] 75. A data cartridge library, as claimed in claim 71, wherein:
said cartridge transport comprises:
means for rotating said grasper about a horizontal axis.
- [c76] 76. A data cartridge library, as claimed in claim 71, wherein:
said cartridge transport comprises:
means for rotating said grasper about a vertical axis.
- [c77] 77. A data cartridge library, as claimed in claim 71, wherein:
said cartridge transport comprises:
means for vertically moving said grasper relative to a data
cartridge magazine so that said grasper is capable of
displacing a data cartridge within a substantially vertical plane.
- [c78] 78. A data cartridge library, as claimed in claim 71, wherein:
said cartridge transport comprises:
means for horizontally moving said grasper relative to a
magazine so that said grasper is capable of displacing a data
cartridge within a substantially vertical plane.
- [c79] 79. A data cartridge library, as claimed in claim 71, wherein:
said cartridge magazine transport device comprises:
a cartridge magazine picker; and
an elevator;
wherein said cartridge transport comprises said elevator.
- [c80] 80. A data cartridge library, as claimed in claim 71, further
comprising:

means for reading a first label and a second that are each potentially associated with a magazine when the magazine is associated with the library and that are each differently oriented to the other;
wherein the first label is associated with a magazine and is located in a first plane;
wherein the second label is associated with a data cartridge and located in a second plane that is different than said first plane.

- [c81] 81. With respect to a magazine-based data cartridge library that is capable of storing a plurality of cartridge magazines on a shelf where a magazine located on a shelf orients data cartridges such that the face of the data cartridge with the greatest surface area lies in a substantially vertical plane, a method for moving a data cartridge from a cartridge magazine stored on a shelf to a player/recorder, the method comprising:
first positioning a magazine picker adjacent to the portion of a shelf on which a magazine that contains a data cartridge is located;
first using, following said step of first positioning, said magazine picker to move said magazine to a site at which at least the portion of the magazine that contains the data cartridge is accessible by a cartridge transport;
second using, following said step of first using, a grasper to

remove the data cartridge from the magazine by displacing the data cartridge such that the data cartridge moves in a substantially vertical plane; and
third using, following said step of second using, said cartridge transport to insert the magazine into the player/recorder.

[c82] 82. A method, as claimed in claim 81, wherein:
said step of first positioning comprises:
using an elevator to move said magazine picker.

[c83] 83. A method, as claimed in claim 82, wherein:
said step of first using comprises:
using a gripper to transfer the magazine from the shelf to a support surface.

[c84] 84. A method, as claimed in claim 83, wherein:
said site comprises the location of said support surface.

[c85] 85. A method, as claimed in claim 81, wherein:
said step of second using comprises:
fourth using a grasper transport to move said grasper to a location immediately adjacent said data cartridge in said magazine.

[c86] 86. A method, as claimed in claim 85, wherein
said step of second using comprises:
fifth using a grasper translator for moving said grasper to engage said data cartridge in said magazine and remove said

data cartridge from said magazine.

[c87] 87. A method, as claimed in claim 81, wherein:
said step of third using comprises:
rotating said data cartridge about a horizontal axis before
inserting said data cartridge in said player/recorder.

[c88] 88. A method, as claimed in claim 81, wherein:
said step of third using comprises:
moving said data cartridge using an elevator that also moves
said cartridge magazine picker before inserting said data
cartridge in said player/recorder.